

A FEW CONSIDERATIONS ON THE ERTS
NO. 1 PICTURES OF THE WET PAMPA AREA --
THE REPUBLIC OF ARGENTINA

Oscar Domingues

(NASA-TT-F-15451) A FEW CONSIDERATIONS
ON THE ERTS NO. 1 PICTURES OF THE WET
PAMPA AREA: THE REPUBLIC OF ARGENTINA
(Kanner (Lec) Associates) ~~44~~ p Hc

N74-19015

Unclas
32010

CSCL 08F G3/13

17

Translation of "Algunas
Consideraciones Acerca de las Imagenes del
ERTS No. 1 en la Region de la Pampa
Humeda -- Republica Argentina," INTA,
Buenos Ares, Argentina, 1974,
Report, 9 pages.



PRICES SUBJECT TO CHANGE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546 MARCH 1974

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

17

STANDARD TITLE PAGE

1. Report No. NASA TT F-15,451	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle A FEW CONSIDERATIONS ON THE ERTS NO. 1 PICTURES OF THE WET PAMPA AREA -- THE REPUBLIC OF ARGENTINA		5. Report Date March 1974	6. Performing Organization Code
		8. Performing Organization Report No.	10. Work Unit No.
7. Author(s) Oscar Dominguez -- INTA		11. Contract or Grant No. NASw-2481	
		13. Type of Report and Period Covered Translation	
9. Performing Organization Name and Address Leo Kanner Associates P. O. Box 5187 Redwood City, California 94036		14. Sponsoring Agency Code	
12. Sponsoring Agency Name and Address NASA, Code KSS-1 Washington, D. C. 20546			
15. Supplementary Notes Translation of "Algunas Consideraciones Acerca de las Imagenes del ERTS No. 1 en la Region de la Pampa Humeda -- Republica Argentina," INTA, Buenos Ares, Argentina, 1974, Report, 9 pages.			
16. Abstract			
17. Key Words (Selected by Author(s))		18. Distribution Statement Unclassified. Unlimited.	
19. Security Classif. (of this report) None	20. Security Classif. (of this page) None	21. No. of Pages 17	22. Price 4.00

A FEW CONSIDERATIONS ON THE ERTS
NO. 1 PICTURES OF THE WET PAMPA AREA --
THE REPUBLIC OF ARGENTINA

Oscar Domingues

A number of factors, such as social, economic, industrial cultural, communications, etc., constitute the basis for differentiating between developed and developing countries. Nevertheless, it is primarily the scientific-technological factor which delineates this difference to such an extent, that if the countries which are falling behind do not make an effort to accelerate their rate of absorption of scientific and technical knowledge they will fall even further behind the developed countries.

/1*

Thus, the gap which separates them will continue to widen constantly and it is easy to predict that, within a short time, taking into account the rapid increase of knowledge, not even a maximum amount of sacrifices could reduce the gap.

Space science and technology represent an outstanding example of what has been stated previously. There is no doubt that the great powers have been favored by the unheralded progress reached in the acquisition of space knowledge and its application, but, as a strange paradox, developing countries and particularly those endowed with a large area will benefit the most from developed space technology, since they will be able to apply same to the study of their vast resources which have not as yet been discovered.

Although during the past few years a number of examples have proven the present usefulness and demonstrated future prospects of application of remote sensors launched into space

*Numbers in the margin indicate pagination in the foreign text.

(either on orbital platforms or from aircraft) for the purpose of studying and taking inventory of natural resources, many experts question and even reject this method, since they consider there are too many problems involved. This should not surprise us, since black and white photography itself, an undisputed sensor which has had more than a century of application, is still the subject of discussion among certain technical experts, not because they prefer data obtained from other sensors, but merely due to lack of knowledge of the true benefit which can be gained from photographic materials.

A lack of interest in aerial photography, displayed by many reconnaissance people, can surely also be ascribed to the use of remote sensors for similar problems. This may be attributed partly to the fact that man feels more secure when he works within the sphere covered by his natural remote sensors and with data which he traditionally can obtain directly on the ground.

To extract information from photographs and other remote sensors obliges the technical experts to set aside traditional methods, to achieve the most accessible and trustworthy ones; he must also engage in new viewpoints in order to study and classify natural resources.

The broad field of application for Remote Sensors will make this problem even more acute, particularly if one takes into account the enormous volume of information which will be received from space platforms, stationed several hundreds of kilometers apart, on a repetitive basis.

It will therefore be necessary to develop the idea of creating new types of useful classifications on natural resources, in such a way as to extract the maximum benefits from the information supplied by the sensors. In order that space science and technology may contribute positively to

the development of people, it will also be necessary to improve the operational possibilities of the space platforms and remote sensors and pay maximum attention (time and money) for the most effective data processing.

In order to make a better evaluation of the possibilities afforded by the ERTS-1, we shall make a comparative analysis between studies and inventories made by man on the Earth's surface and those made up to the present from the lunar surface.

- a. We know that more than a million years ago man began to walk on the surface of the land, and that from historical times has devoted himself to the constant task which becomes more and more intensive of taking inventory and developing his principal resources, in order to satisfy his most direct and growing needs.

On the other hand, man has only been able to walk on the surface of the moon during the last five (5) years; however, he has covered only four (4) small areas, which, in proportion to the total satellite surface, is evidently a very insignificant part.

- b. The continental area of the Earth is approximately four (4) times larger than the moon surface which is estimated at 38 million km².
- c. Earth is surrounded by an atmosphere which contains a large percentage of clouds which act as screens and cause a reduction in the number of good photographs which can be obtained from great heights, and sometimes completely rule out the possibility of taking pictures. This factor constitutes the most serious handicap for Remote Sensors working from satellites.

On the other hand, on the moon there is not atmosphere. This makes it possible, therefore, to obtain photographs from its surface at all times, so long as there is sufficient sunlight.

- d. Earth pictures are rich in color variety, whereas moon pictures only come out in grey tones.
- e. The physiographic elements found on Earth's surface are far more varied and complex than those existing on the moon's surface, if one wishes to make a comparison.
- f. Without going into isolated cases, Earth has been studied and inventoried as to its natural resources, following a work pattern which goes from specifics to generalities. The moon, on the other hand, from the beginning has been studied and mapped out following an opposite pattern, i.e., going from generalities to specifics. In the year 1647 the first map of its visible surface was drawn, on the basis of facts obtained from telescopes.
- g. There is no homogeneity in the type of knowledge acquired and the taking of inventories and drawing of maps of the continental Earth surface. On the contrary, great differences are pointed out, as to scale, exactness and methodology applied when one analyses all the documentation produced up to now on a general basis.

Nevertheless, the moon is known uniformly, on both its visible and non-visible sides, and maps of its whole surface have already been drawn.

To summarize the above ideas, we can therefore state that as long as man only had the telescope as an efficient means to observe celestial bodies, he was limited to studying the moon from considerable distances. However, once he was able to get closer to the moon and obtain pictures of its surface through Remote Sensors, he was able to draw precise maps in a relatively short period of time.

/3

Undoubtedly, reconnaissance programs of the lunar soil, both those made directly by man and the ones carried out by telecommand systems were feasible on the basis of information and data previously gathered via remote sensors. Let us think about how different the results would have been which were obtained from recent direct reconnaissance studies of the lunar surface, had we not been able to rely on maps previously charted from information received from the remote sensors.

Obviously, the study of the lunar surface represents an undertaking of great magnitude which, under the realm of circumstances and scope of possibilities afforded in the last few years, was responsible for the spectacular progress in scientific and technological space knowledge. This was achieved rationally following the logical process from generalities to specifics.

On the other hand, Earth was not so fortunate in this sense. Man initiated his study by trying to investigate and sought knowledge of the land surrounding him, as could be expected. Later, technical and economic factors led him to broaden his fields of study, and he created work methods which were based primarily on exact observations which were transformed into aerial ones by extrapolation.

The use of photographs taken from aircraft allowed the modification of this common framework within which all investigators of natural resources were encompassed up to now. At present, pictures taken from satellites require a new framework whose primary purpose shall be to first obtain a total and homogeneous knowledge of our planet, on an adequate scale, in order to later continue with work which successively becomes more detailed in areas which justify this.

In order to understand the possibilities provided by pictures which are taken from the ERTS-1 satellite, for studies of the Earth's surface, we must take into account its principal characteristics:

- a. A great synoptic vision which notably improves that obtained up to now from aircraft.
- b. Periodic picture repetition, containing a great aerial coincidence of the surface covered by each in the successive takes, totally improving what has been achieved up to the present time.
- c. Obtaining pictures on different electromagnetic spectrum bands.
- d. Obtaining pictures of large surface areas with the same solar angle, which represents a totally new possibility in the history of aerial photography.
- e. Considerable reduction in field determination of pictures, compared to aerial photographs obtained from aircraft.
- f. Limited work capacity of the whole sensor system, installed in the satellite.
- g. Technical disadvantages in the satellite, sensors, recorders, etc., which reduce the projected work capacity.
- h. Impossibility of modifying the date of each orbit of the satellite. /4
- i. Presence of clouds which cover the Earth's surface at the time when the satellite passes over a location.

To obtain the full advantage of space pictures, to which practically all technical experts have not as yet become accustomed, requires the use of new approaches and interpretation techniques. For example, it will be necessary to pay special attention to the subtle changes which affect the tone, color and texture of the pictures and consider the presence of new patterns.

Research made on special pictures with a view to the massive use of pictures taken from ERTS-1 shows the presence of certain difficulties in the determination and/or interpretation

of some elements of the Earth's surface, due to the low field determination of the said pictures. However, on the other hand, the great synoptic vision which these pictures afford make the delimitation of large- and medium-sized areas with homogeneous characteristics possible, and allow the uninterrupted following of the development of large structures, as well as relating the elements of the Earth's surface with ease.

As has been stated previously, one of the basic characteristics of information gathered from satellites is that it may be repetitive without greatly increasing the initial launching costs. This could not previously be achieved in any great area, without leaving large gaps which could not be recovered by photography. Sequential takes of pictures made a number of times during the course of a year were only used in research, such as that which has been carried on for a number of years by NASA.

In the Pampa area, which has a surface of approximately 600,000 km², the sky is totally or partially covered by clouds some 80% of the days of the year.

The following list contains a series of locales showing the number of days which, according to statistics, are cloud-free during the course of one year, which amount may also include other days when photographs cannot be taken, due to other causes.

Balcarce 72 days -- Mar del Plate 67 -- Necochea 68 --
Pinamar 82 -- San Clemente del Tuyu 124 -- Bahia Blanca 85 --
Patagonia 52 -- Dolores 52 -- Las Flores 66 -- Junin 80 --
Rehuago 103 -- Pigue 81 -- Tres Arroyos 43 -- Trenque Lauquen
94 -- General Villegas 79.

This shows that the Pampean area, taking into account the blanket produced by the clouds, apparently would not be an ideal area for gathering data from the satellite due to the

fact that the orbits are made on a fixed date and there is no possibility of avoiding the presence of clouds.

If an analysis is made of all the photographs obtained by the ERTS-1 during the course of a year, we shall see the results obtained and have a clearer picture of the efficiency level we can anticipate from the satellite in this region.

However, in order to make a truer judgment, we must also consider that it is possible for us to know exactly when the satellite did not take pictures due to the program itself set by NASA and when it did not take them due to difficulties encountered in the operation of the sensors.

The satellite required 8 orbits and 45 pictures in order to cover the whole surface of the area.

In Table No. 1 it can be seen that during one work year, the satellite made 20 sweeps and only obtained pictures from 10 of them. These 10 sweeps produced 98 pictures, in each one of the four bands of the MSS sensor, which indicates that a little less than half of these pictures had to be used in order to prepare the photo mosaic of the whole area with the 45 pictures already mentioned (see Graphs 1 through 10).

/5

Of the 98 pictures obtained, 63 contained clouds with different degrees of recovery, which gives us 64% totally or partially covered by clouds.

Likewise, within the total of the 98 pictures, 19 correspond to winter; 24 to spring; 55 to summer and none to autumn.

In two successive sweeps made at the end of the summer, 53 of the photographs were obtained.

Although summer is the season with the greatest percentage of pictures, it also contains the greatest percentage of pictures with clouds, reaching almost 82%.

In observing the graphs which show the geographical distribution of the pictures obtained in each sweep of the satellite, the conclusion reached is that NASA placed special interest in the possibility of completing a photo mosaic of the whole wet Pampean area, and that the clouds reduce the usable surface of the pictures with a greater intensity in the western sector of same.

In Graph No. 11, which shows the sketch of the mosaic arranged in order with the pictures from the satellite, it can be seen that 8 sweeps were necessary and that the clouds had voided certain areas in the band corresponding to Orbit No. 3 by covering 4.5% of its total surface.

In graph No. 12, which shows the areas covered by a different number of pictures, we can see that the areas covered by only one picture only constitute 5% of the total surface of the mosaic; that the areas with two pictures cover 71%, that the areas with three pictures cover 15% and, finally, that the areas with four pictures correspond to 9%. However, due to the presence of clouds, in the 11 sweeps of the satellite, the percentages of useful surfaces with picture repeats are less than those already mentioned.

After this brief outline regarding the geographic distribution of the pictures taken by the ERTS-1, the repeat photos and those whose Earth's surface were completely covered due to the presence of clouds, we shall make a few comments on the quality and usefulness of the pictures.

The whole area of the Wet Pampa covered by the pictures taken by the ERTS is also covered by aerial photography made on different scales and on different dates. Among the photo recoveries there is one of optimum quality made to the scale of 1:20,000 which has mosaics semi-supported to the same scale.

After being apprised of this information, it is logical that the majority would ask, what advantage can be obtained from the photographs of the ERTS-1 which is greater than the potential information which is contained in the photographs 1:20,000. This question shall be answered by the total considerations which are set forth, as follows, clarifying that our opinion regarding the usefulness of the ERTS-1 photographs was arrived at exclusively from the study effected, on a lighted table and with the naked eye, of the slides on four bands in the format of 18 x 18 cm and the enlargements, as well, to 5 x 1 on semiglossy paper of 7 of those same slides on the band. No other instruments, such as projectors, blowup of pictures, etc., were used, due to the very simple reason that we do not have /6 them.

1. The first fact that shows up in observing the ERTS-1 pictures is that, for the first time in regional studies, we are able to look at Earth's surface from the best location, and we see it such as it is. The most surprising element is that of proving that all prior experiences which had been accumulated during 30 years of work in the field, through airplane surveys, the study of cartography and the existing large scale aerial photos, complemented with the corresponding bibliography, now serve as a valuable aid for the better understanding of the ERTS-1 pictures. But all this accumulation of data can never replace the information and understanding of regional phenomena which the ERTS-1 pictures display.

It could be surmised that with the mosaic prepared to the scale of 1:20,000 of the Wet Pampa, which is available, by reduction a mosaic to the scale of 1:200,000 could be prepared and that the same or even more information could be extracted beyond that provided by the ERTS-1 pictures.

At INTA, before counting upon the satellite pictures, we made this test with the idea of having a synoptic view of the subregion called the depressed Pampa, having an approximate area of $140,000 \text{ km}^2$. For this purpose, original mosaics (original scale 1:20,000) were reduced and were taken to the scale of 1:200,000 in order to later assemble them and prepare one equivalent mosaic only, by its surface, to only 4 1/2 pictures of the ERTS-1. There is not one cloud in this mosaic, but the possibilities afforded of extracting information from its pictures are considerably less than those offered by the pictures taken by the satellite.

The reasons are obvious: first, due to the fact that as long as the picture of the satellite is the product of a fraction of a second, the total picture of the mosaic is that which results from 23,000 aerial photos to the scale of 1:20,000 taken throughout a period of two years. This means that pictures corresponding to different seasons of the year and different hours of the day have been assembled, which not only record different phenomena of the Earth's surface, due to its disfiguration throughout time, but also record different aspects of the same phenomena, due to the fact that they have been photographed with a different solar angle and different lighting. Moreover, one must take into account that in order to prepare a mosaic of that magnitude, it is necessary to match the photographic tones. Although this factor aids in the presentation of the whole, it also causes the reduction of possibilities of following many phenomena of the Earth's surface on these pictures for long distances or large surface areas.

During its orbit of August 31, 1972, the ERTS-1 satellite obtained, in 2 minutes and 30 seconds, an almost cloudless picture of a surface area 185 km wide by 1180 km long, showing a series of geographical phenomena which could, for the first time, be regionalized with its needed clearness. It is practically impossible to obtain this type of mosaic by means of conventional aerial flights.

Earth's surface has what could be called a superficial layer, which changes its face constantly in a variable form according to areas. This change is very noticeable in an area such as the Wet Pampa, where the purposes for which man utilizes the land, in that so-called layer, produce a periodic and continuous change, which up to now had only been possible to observe on small surface areas. The ERTS pictures taken during different seasons of the year, provide, for the first time, the possibility of regionalizing those changes and the better understanding of the existing relationship between nature and man's work in the field. /7

On census maps, it is possible to separate areas which contain rural property within certain values as to its surface, in order to thus obtain theoretical or practical conclusions of various kinds.

What had not been achieved was the delimitation of large areas which group together pasture lands of a certain size instead of property; this can be done with great precision on the ERTS pictures. The importance of delimiting these homogeneous areas, as regards the size of the pasture lands is based on the following:

- 1) The size of the pasture lands on each range is not accidental, but rather the result of a whole process, slow or rapid, decantation which begins with the first use made of the land and which, actually, only corresponds to one of the stages of its evolution.
- 2) This stage which we see at present, through the ERTS photo is the result, up to date, of the interaction of ecological forces which put into play the natural elements of a specific area and the forces man implements through his technical culture, communications media, markets, competition, etc.
- 3) In general, areas with pasture lands of equal size can be easily separated from the other areas, and it is only in certain cases that passing from one area to another takes place in a gradual fashion.
- 4) Also, the areas, in addition to differentiation due to the size of the pasture lands, can be specified through different degrees of contrast in the photographic tones of the pictures. When ecological conditions are best, there is a greater contrast between the pasture lands and, on the other hand, when the ecological conditions are least advantageous, there is less contrast in the photographic tones of the pictures of the pasture lands.

The comparative study of pictures at different dates which correspond to the same areas not only shows the stage of work in the fields, but also, for example, can determine areas covered by floods, how long they last, and whether or not those floods are due to local rains or increasing ones emanating from far away at the upper end of river basins or because of both

conditions. These three photos of the fluvial plain of the Parana River very clearly show what has been stated above.

In the Argentine Republic, a law has just been enacted which discusses agrarian taxation based on the normal income potential of the land. The law stipulates that, as a basic condition for making this law operational, it will be necessary to subdivide the country into ecological-economic areas. There is no doubt that the satellite pictures may be the ideal tool to achieve this first aim.

To conclude, we shall state that the ERTS-1 satellite took pictures for one year of almost the whole Argentine territory; these pictures represent the ideal instrument for those who are /8 desirous that the whole country be known integrally, as the first frame for future work on a larger scale and in greater detail. This tool has been available for more than a year for those who wish to use it and we would hope that the greatest benefits may be obtained from its use.

PICTURES MADE BY ERTS-1
WET PAMPA -- REPUBLIC
OF ARGENTINA

TABLE NO. 1

References: 0 = Orbit
M = Photo mosaic
N = Clouds

Dates of
No. 8 Orbits
Orbits

Dates No. 8 Orbits	ORBITS																								Dates of Orbits No. 1	Number of Pictures from the 8 Orbits	Number of Pictures per Station				
	8	7	6	5	4	3	2	1																							
	NUMBER OF PICTURES																														
	O	M	N	O	M	N	O	M	N	O	M	N	O	M	N	O	M	N	O	M	N	O	M	N							
2- 9-72	2	2	2	4	4	2	7	7	1	3	3	0													26- 8-72	16	16	5	19	18	8
20- 9-72																									13- 9-72	0	0	0			
8-10-72										3	3	0	5	1	3										1-10-72	8	4	3			
26-10-72																	4	2 1/2	3						19-10-72	4	2 1/2	3			
13-11-72	1	0	1	3	1	3				4	1	1													6-11-72	8	2	5			
1-12-72																									24-11-72	0	0	0			
19-12-72						4	0	4																	12-12-72	4	0	4	24	8 1/2	15
6- 1-73																									30-12-72	0	0	0			
24- 1-73											2	1	1												17- 1-73	2	1	1			
11- 2-73											1	0	1												4- 2-73	1	0	1			
1- 3-73	2	0	2	2	0	2	6	1	3	8	1	2	6	6	1	1	0	1	0	3	3	3			22- 2-73	28	11	14			
19- 3-73	1	0	1			1	0	1	4	0	4	6	0	6	5	5	5	4	1 1/2	4	3	0	3		13- 3-73	24	6 1/2	24	55	18 1/2	45
6- 4-73																									30- 3-73	0					
24- 4-73																									17- 4-73	0					
12- 5-73																									5- 5-73	0					
30- 5-73																									23- 5-73	0					
17- 6-73																									10- 6-73	0			0	0	0
5- 7-73																									28- 6-73	0					
23- 7-73																									16- 7-73	0					
10- 8-73											3	2	3												2- 8-73	3	2	3			
	6	2	6	9	5	7	18	8	9	22	9	7	20	8	12	9	7	9	8	4	7	6	3	6		93	45	63	TOTALS		

Winter

Spring

Summer

Fall